Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.3.15
Printed on 24 October 2016 at 14:55:57

Project Information:

Assessed By: Leanne Brooksbank (STRO004241) **Building Type:** Detached House

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 605.06m²

Site Reference : New Project **Plot Reference:** Detached House

Address : Detached House, Ferry Lane, Breighton

Client Details:

Name: Russ Cullingworth

Address : Capital Construction, Unit 1, Common Lane Yard, Burn, YO8 8LB

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Oil
Fuel factor: 1.17 (oil)

Target Carbon Dioxide Emission Rate (TER)	14.85 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	14.85 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	57.1 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	47.6 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.30 (max. 0.70)	**OK**
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	**OK**
Roof	0.15 (max. 0.20)	0.22 (max. 0.35)	**OK**
Openings	1.25 (max. 2.00)	1.80 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.50 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system:	Boiler systems with radiators or underfloor heating - heating oil Data from manufacturer Efficiency 90.0 % SEDBUK2009 Minimum 88 %	**OK**
Secondary heating system:	Room heaters - wood Data from manufacturer - Closed room heater Efficiency 80.0 % Minimum 65.0 %	**OK**

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 3.00 kWh/day	
	Permitted by DBSCG: 3.92 kWh/day	OK
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls	TTZC by plumbing and electrical services	OK
Hot water controls:	Cylinderstat	OK
	Independent timer for DHW	OK
Boiler interlock:	Yes	OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (East Pennines):	Not significant	OK

Based on:

Overshading:	Average or unknown
Windows facing: West	17.75m²
Windows facing: West	1.44m²
Windows facing: North West	4.5m²
Windows facing: South West	4.5m²
Windows facing: East	15.07m²
Windows facing: South	25.3m²
Windows facing: North	4.05m²
Roof windows facing: East	3.12m²
Roof windows facing: South	1.56m²
Ventilation rate:	4.00
Blinds/curtains:	None
	Closed 100% of daylight hours

10 Key features

Thermal bridging	0.022 W/m²K
Roofs U-value	0.09 W/m²K
Floors U-value	0.11 W/m²K
Secondary heating (wood logs)	
Secondary heating fuel wood logs	

Predicted Energy Assessment

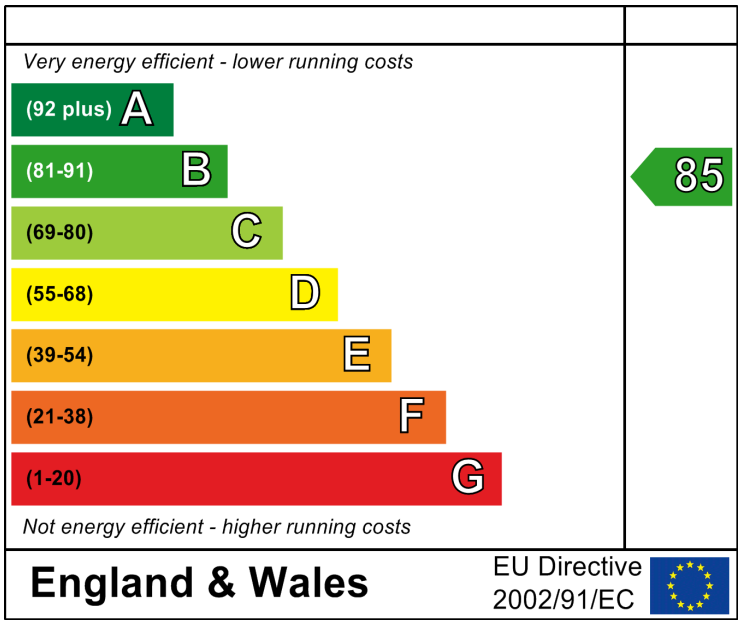
Detached House
Ferry Lane
Breighton

Dwelling type:	Detached House
Date of assessment:	06 May 2016
Produced by:	Leanne Brooksbank
Total floor area:	605.06 m²

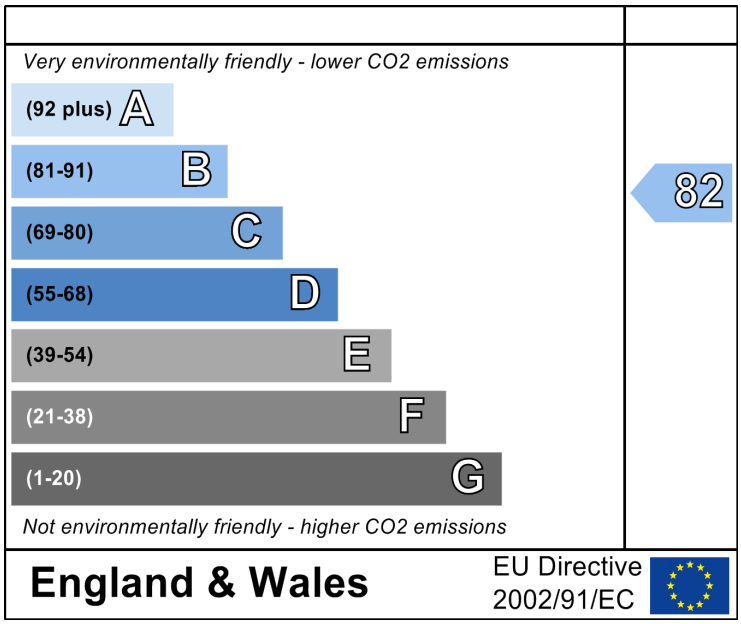
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



Environmental Impact (CO_2) Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

SAP Input

Property Details: Detached House

Address:	Detached House, Ferry Lane, Breighton
Located in:	England
Region:	East Pennines
UPRN:	
Date of assessment:	06 May 2016
Date of certificate:	24 October 2016
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	400

Property description:

Dwelling type:	House
Detachment:	Detached
Year Completed:	2016

Floor Location:	Floor area:	Storey height:
Floor 0	320.96 m²	2.74 m
Floor 1	196.29 m²	2.67 m
Floor 2	87.81 m²	2.41 m

Living area:	51.667 m² (fraction 0.085)
Front of dwelling faces:	West

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
West door	Manufacturer	Half glazed	low-E, En = 0.05, soft coat	No	PVC-U
South door	Manufacturer	Half glazed	low-E, En = 0.05, soft coat	No	PVC-U
North door	Manufacturer	Half glazed	low-E, En = 0.05, soft coat	No	PVC-U
West elevation	Manufacturer	Windows	low-E, En = 0.05, soft coat	No	
Wesr dormer windows	Manufacturer	Windows	low-E, En = 0.05, soft coat	No	
Bays	Manufacturer	Windows	low-E, En = 0.05, soft coat	No	
Bays	Manufacturer	Windows	low-E, En = 0.05, soft coat	No	
East elevation	Manufacturer	Windows	low-E, En = 0.05, soft coat	No	
South elevation	Manufacturer	Windows	low-E, En = 0.05, soft coat	No	
North elevation	Manufacturer	Windows	low-E, En = 0.05, soft coat	No	
East roof windows	Manufacturer	Roof Windows	low-E, En = 0.05, soft coat	No	PVC-U
South roof windows	Manufacturer	Roof Windows	low-E, En = 0.05, soft coat	No	PVC-U

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
West door	16mm or more mm	0.7	0.63	1.8	3.07	1
South door	16mm or more mm	0.7	0.63	1.8	1.68	1
North door	16mm or more mm	0.7	0.63	1.8	1.68	1
West elevation	16mm or more	0.75	0.5	1.2	17.754	1
Wesr dormer windows	16mm or more	0.75	0.5	1.2	1.44	1
Bays	16mm or more	0.75	0.5	1.2	4.5	1
Bays	16mm or more	0.75	0.5	1.2	4.5	1
East elevation	16mm or more	0.75	0.5	1.2	15.069	1
South elevation	16mm or more	0.75	0.5	1.2	25.302	1
North elevation	16mm or more	0.75	0.5	1.2	4.05	1
East roof windows	16mm or more	0.75	0.5	1.2	3.115	1
South roof windows	16mm or more	0.75	0.5	1.2	1.557	1

SAP Input

Name:	Type-Name:	Location:	Orient:	Width:	Height:
West door		External walls	West	0	0
South door		External walls	South	0	0
North door		External walls	North	0	0
West elevation		External walls	West	0	0
Wesr dormer windows		Dormer walls	West	0	0
Bays		External walls	North West	0	0
Bays		External walls	South West	0	0
East elevation		External walls	East	0	0
South elevation		External walls	South	0	0
North elevation		External walls	North	0	0
East roof windows		Sloped roof	East	0	0
South roof windows		Sloped roof	South	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
External walls	455.493	77.61	377.89	0.2	0	False	N/A
Garage wall	18.267	0	18.27	0.19	0.33	False	N/A
Stud walls	112.234	0	112.23	0.3	0.5	False	N/A
Dormer walls	7.875	1.44	6.43	0.3	0	False	N/A
Plane roof	132.69	0	132.69	0.09	0		N/A
Sloped roof	92.604	4.67	87.93	0.18	0		N/A
Dormer roof	4.32	0	4.32	0.22	0		N/A
Bay roof	2.64	0	2.64	0.22	0		N/A
Roof behind studs	102.79	0	102.79	0.22	0.5		N/A
Ground floor	320.96			0.11			N/A
Internal Elements							
Party Elements							

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0221

	Length	Psi-value		
	41.372	0.05	E2	Other lintels (including other steel lintels)
	30.972	0.03	E3	Sill
	102.9	0.018	E4	Jamb
	101.77	0.077	E5	Ground floor (normal)
	139.47	0.005	E6	Intermediate floor within a dwelling
	57.1	0.035	E10	Eaves (insulation at ceiling level)
	9.09	-0.002	E11	Eaves (insulation at rafter level)
	30.55	0.035	E12	Gable (insulation at ceiling level)
[Approved]	14.4	0.04	E13	Gable (insulation at rafter level)
	45.35	0.048	E16	Corner (normal)
	27.2	-0.09	E17	Corner (inverted internal area greater than external area)
[Approved]	20.68	0.09	E16	Corner (normal)
[Approved]	16.8	-0.09	E17	Corner (inverted internal area greater than external area)
	5.26	0.24	E24	Eaves (insulation at ceiling level - inverted)
	7.64	0.08	E14	Flat roof
	49	0.06	R6	Flat ceiling
	56.58	0.06	R8	Roof wall (rafter)
	12.3	0.04	R9	Roof wall (flat ceiling)
	3.96	0.08	R1	Head
	3.96	0.06	R2	Sill
	14.16	0.08	R3	Jamb
	2.7	0.04	R7	Flat ceiling(inverted)

SAP Input

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Natural ventilation (extract fans)
Number of chimneys:	0
Number of open flues:	0
Number of fans:	7
Number of passive stacks:	0
Number of sides sheltered:	0
Pressure test:	5.5

Main heating system:

Main heating system:	Boiler systems with radiators or underfloor heating Gas boilers and oil boilers Fuel: heating oil Info Source: Manufacturer Declaration Manufacturer's data Efficiency: 90.0% (SEDBUK2009) Standard oil boiler, 1998 or later Systems with radiators Central heating pump : 2013 or later Design flow temperature: Design flow temperature >45°C Room-sealed Boiler interlock: Yes Delayed start

Main heating Control:

Main heating Control:	Time and temperature zone control by suitable arrangement of plumbing and electrical services Control code: 2110

Secondary heating system:

Secondary heating system:	Room heaters Solid fuel room heaters Fuel :wood logs Info Source: Manufacturer Declaration Closed room heater HETAS Approved

Water heating:

Water heating:	From main heating system Water code: 901 Fuel :heating oil Hot water cylinder Cylinder volume: 500 litres Cylinder insulation: Measured loss, 3kWh/day Primary pipework insulation: True Cylinderstat: True Cylinder in heated space: True Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Low rise urban / suburban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None

SAP Input

Assess Zero Carbon Home:	No

SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Leanne Brooksbank	**Stroma Number:**	STRO004241
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.3.15

Property Address: Detached House

Address : Detached House, Ferry Lane, Breighton

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	320.96 (1a)	x	2.74 (2a)	=	879.43	(3a)
First floor	196.29 (1b)	x	2.67 (2b)	=	524.09	(3b)
Second floor	87.81 (1c)	x	2.41 (2c)	=	211.62	(3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	605.06	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	1615.15	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							7	x 10 =	70	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	70	÷ (5) =	0.04 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5.5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.32 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		1 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.32 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

SAP WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors Type 1			3.07	x	1.8	=	5.526			(26)
Doors Type 2			1.68	x	1.8	=	3.024			(26)
Doors Type 3			1.68	x	1.8	=	3.024			(26)
Windows Type 1			17.754	x1/[1/(1.2)+ 0.04]		=	20.33			(27)
Windows Type 2			1.44	x1/[1/(1.2)+ 0.04]		=	1.65			(27)
Windows Type 3			4.5	x1/[1/(1.2)+ 0.04]		=	5.15			(27)
Windows Type 4			4.5	x1/[1/(1.2)+ 0.04]		=	5.15			(27)
Windows Type 5			15.069	x1/[1/(1.2)+ 0.04]		=	17.25			(27)
Windows Type 6			25.302	x1/[1/(1.2)+ 0.04]		=	28.97			(27)
Windows Type 7			4.05	x1/[1/(1.2)+ 0.04]		=	4.64			(27)
Rooflights Type 1			3.115	x1/[1/(1.2) + 0.04]		=	3.738			(27b)
Rooflights Type 2			1.557	x1/[1/(1.2) + 0.04]		=	1.8684			(27b)
Floor			320.96	x	0.11	=	35.3056			(28)
Walls Type1	455.49	77.61	377.89	x	0.2	=	75.58			(29)
Walls Type2	18.27	0	18.27	x	0.18	=	3.27			(29)
Walls Type3	112.23	0	112.23	x	0.26	=	29.28			(29)
Walls Type4	7.88	1.44	6.43	x	0.3	=	1.93			(29)

SAP WorkSheet: New dwelling design stage

Roof Type1	132.69	0	132.69	x	0.09	=	11.94		(30)
Roof Type2	92.6	4.67	87.93	x	0.18	=	15.83		(30)
Roof Type3	4.32	0	4.32	x	0.22	=	0.95		(30)
Roof Type4	2.64	0	2.64	x	0.22	=	0.58		(30)
Roof Type5	102.79	0	102.79	x	0.2	=	20.37		(30)
Total area of elements, m²			1249.87						(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 295.1 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 27.58 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 322.69 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	310.4	308.7	307.03	299.18	297.71	290.87	290.87	289.61	293.51	297.71	300.68	303.79	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	633.09	631.38	629.71	621.86	620.39	613.56	613.56	612.29	616.19	620.39	623.37	626.47	

Average = Sum(39)$_{1...12}$ /12= 621.86 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.05	1.04	1.04	1.03	1.03	1.01	1.01	1.01	1.02	1.03	1.03	1.04	

Average = Sum(40)$_{1...12}$ /12= 1.03 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 3.53 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 118 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	129.8	125.08	120.36	115.64	110.92	106.2	106.2	110.92	115.64	120.36	125.08	129.8	

Total = Sum(44)$_{1...12}$ = 1416.02 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	192.49	168.36	173.73	151.46	145.33	125.41	116.21	133.35	134.94	157.26	171.67	186.42	

Total = Sum(45)$_{1...12}$ = 1856.63 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	28.87	25.25	26.06	22.72	21.8	18.81	17.43	20	20.24	23.59	25.75	27.96	(46)

SAP WorkSheet: New dwelling design stage

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel		500	(47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):		3	(48)
Temperature factor from Table 2b		0.54	(49)
Energy lost from water storage, kWh/year	(48) x (49) =	1.62	(50)
b) If manufacturer's declared cylinder loss factor is not known:			
Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)
If community heating see section 4.3			
Volume factor from Table 2a		0	(52)
Temperature factor from Table 2b		0	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		1.62	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	50.22	45.36	50.22	48.6	50.22	48.6	50.22	50.22	48.6	50.22	48.6	50.22	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	50.22	45.36	50.22	48.6	50.22	48.6	50.22	50.22	48.6	50.22	48.6	50.22	(57)

Primary circuit loss (annual) from Table 3: 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	265.98	234.73	247.21	222.57	218.81	196.52	189.69	206.83	206.06	230.75	242.78	259.9	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	265.98	234.73	247.21	222.57	218.81	196.52	189.69	206.83	206.06	230.75	242.78	259.9	

Output from water heater (annual)$_{1...12}$: 2721.83 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	122.79	109.08	116.55	107.25	107.11	98.59	97.43	103.13	101.76	111.08	113.97	120.77	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	211.71	211.71	211.71	211.71	211.71	211.71	211.71	211.71	211.71	211.71	211.71	211.71	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	159.16	141.36	114.96	87.04	65.06	54.93	59.35	77.15	103.54	131.47	153.45	163.58	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	1007.11	1017.56	991.22	935.16	864.38	797.87	753.43	742.98	769.32	825.38	896.15	962.67	(68)

SAP WorkSheet: New dwelling design stage

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	59.7	59.7	59.7	59.7	59.7	59.7	59.7	59.7	59.7	59.7	59.7	59.7	(69)

Pumps and fans gains (Table 5a)

(70)m=	13	13	13	13	13	13	13	13	13	13	13	13	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-141.14	-141.14	-141.14	-141.14	-141.14	-141.14	-141.14	-141.14	-141.14	-141.14	-141.14	-141.14	(71)

Water heating gains (Table 5)

(72)m=	165.04	162.31	156.65	148.96	143.96	136.93	130.95	138.61	141.33	149.3	158.29	162.33	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	1474.57	1464.5	1406.11	1314.42	1216.68	1132.99	1087	1102.01	1157.46	1249.42	1351.16	1431.85	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	4.05	x	10.63	x	0.5	x	0.75	=	11.19	(74)
North	0.9x 0.77	x	4.05	x	20.32	x	0.5	x	0.75	=	21.39	(74)
North	0.9x 0.77	x	4.05	x	34.53	x	0.5	x	0.75	=	36.34	(74)
North	0.9x 0.77	x	4.05	x	55.46	x	0.5	x	0.75	=	58.38	(74)
North	0.9x 0.77	x	4.05	x	74.72	x	0.5	x	0.75	=	78.64	(74)
North	0.9x 0.77	x	4.05	x	79.99	x	0.5	x	0.75	=	84.18	(74)
North	0.9x 0.77	x	4.05	x	74.68	x	0.5	x	0.75	=	78.6	(74)
North	0.9x 0.77	x	4.05	x	59.25	x	0.5	x	0.75	=	62.36	(74)
North	0.9x 0.77	x	4.05	x	41.52	x	0.5	x	0.75	=	43.7	(74)
North	0.9x 0.77	x	4.05	x	24.19	x	0.5	x	0.75	=	25.46	(74)
North	0.9x 0.77	x	4.05	x	13.12	x	0.5	x	0.75	=	13.81	(74)
North	0.9x 0.77	x	4.05	x	8.86	x	0.5	x	0.75	=	9.33	(74)
East	0.9x 1	x	15.07	x	19.64	x	0.5	x	0.75	=	76.91	(76)
East	0.9x 1	x	15.07	x	38.42	x	0.5	x	0.75	=	150.46	(76)
East	0.9x 1	x	15.07	x	63.27	x	0.5	x	0.75	=	247.78	(76)
East	0.9x 1	x	15.07	x	92.28	x	0.5	x	0.75	=	361.37	(76)
East	0.9x 1	x	15.07	x	113.09	x	0.5	x	0.75	=	442.88	(76)
East	0.9x 1	x	15.07	x	115.77	x	0.5	x	0.75	=	453.36	(76)
East	0.9x 1	x	15.07	x	110.22	x	0.5	x	0.75	=	431.62	(76)
East	0.9x 1	x	15.07	x	94.68	x	0.5	x	0.75	=	370.76	(76)
East	0.9x 1	x	15.07	x	73.59	x	0.5	x	0.75	=	288.18	(76)
East	0.9x 1	x	15.07	x	45.59	x	0.5	x	0.75	=	178.53	(76)
East	0.9x 1	x	15.07	x	24.49	x	0.5	x	0.75	=	95.9	(76)
East	0.9x 1	x	15.07	x	16.15	x	0.5	x	0.75	=	63.25	(76)
South	0.9x 0.77	x	25.3	x	46.75	x	0.5	x	0.75	=	307.41	(78)
South	0.9x 0.77	x	25.3	x	76.57	x	0.5	x	0.75	=	503.46	(78)

SAP WorkSheet: New dwelling design stage

South	0.9x	0.77	x	25.3	x	97.53	x	0.5	x	0.75	=	641.32	(78)
South	0.9x	0.77	x	25.3	x	110.23	x	0.5	x	0.75	=	724.83	(78)
South	0.9x	0.77	x	25.3	x	114.87	x	0.5	x	0.75	=	755.32	(78)
South	0.9x	0.77	x	25.3	x	110.55	x	0.5	x	0.75	=	726.89	(78)
South	0.9x	0.77	x	25.3	x	108.01	x	0.5	x	0.75	=	710.22	(78)
South	0.9x	0.77	x	25.3	x	104.89	x	0.5	x	0.75	=	689.72	(78)
South	0.9x	0.77	x	25.3	x	101.89	x	0.5	x	0.75	=	669.93	(78)
South	0.9x	0.77	x	25.3	x	82.59	x	0.5	x	0.75	=	543.03	(78)
South	0.9x	0.77	x	25.3	x	55.42	x	0.5	x	0.75	=	364.39	(78)
South	0.9x	0.77	x	25.3	x	40.4	x	0.5	x	0.75	=	265.63	(78)
Southwest	0.9x	0.77	x	4.5	x	36.79		0.5	x	0.75	=	43.03	(79)
Southwest	0.9x	0.77	x	4.5	x	62.67		0.5	x	0.75	=	73.29	(79)
Southwest	0.9x	0.77	x	4.5	x	85.75		0.5	x	0.75	=	100.28	(79)
Southwest	0.9x	0.77	x	4.5	x	106.25		0.5	x	0.75	=	124.25	(79)
Southwest	0.9x	0.77	x	4.5	x	119.01		0.5	x	0.75	=	139.18	(79)
Southwest	0.9x	0.77	x	4.5	x	118.15		0.5	x	0.75	=	138.17	(79)
Southwest	0.9x	0.77	x	4.5	x	113.91		0.5	x	0.75	=	133.21	(79)
Southwest	0.9x	0.77	x	4.5	x	104.39		0.5	x	0.75	=	122.08	(79)
Southwest	0.9x	0.77	x	4.5	x	92.85		0.5	x	0.75	=	108.58	(79)
Southwest	0.9x	0.77	x	4.5	x	69.27		0.5	x	0.75	=	81	(79)
Southwest	0.9x	0.77	x	4.5	x	44.07		0.5	x	0.75	=	51.54	(79)
Southwest	0.9x	0.77	x	4.5	x	31.49		0.5	x	0.75	=	36.82	(79)
West	0.9x	0.77	x	17.75	x	19.64	x	0.5	x	0.75	=	90.62	(80)
West	0.9x	0.77	x	1.44	x	19.64	x	0.5	x	0.75	=	7.35	(80)
West	0.9x	0.77	x	17.75	x	38.42	x	0.5	x	0.75	=	177.27	(80)
West	0.9x	0.77	x	1.44	x	38.42	x	0.5	x	0.75	=	14.38	(80)
West	0.9x	0.77	x	17.75	x	63.27	x	0.5	x	0.75	=	291.93	(80)
West	0.9x	0.77	x	1.44	x	63.27	x	0.5	x	0.75	=	23.68	(80)
West	0.9x	0.77	x	17.75	x	92.28	x	0.5	x	0.75	=	425.76	(80)
West	0.9x	0.77	x	1.44	x	92.28	x	0.5	x	0.75	=	34.53	(80)
West	0.9x	0.77	x	17.75	x	113.09	x	0.5	x	0.75	=	521.79	(80)
West	0.9x	0.77	x	1.44	x	113.09	x	0.5	x	0.75	=	42.32	(80)
West	0.9x	0.77	x	17.75	x	115.77	x	0.5	x	0.75	=	534.14	(80)
West	0.9x	0.77	x	1.44	x	115.77	x	0.5	x	0.75	=	43.32	(80)
West	0.9x	0.77	x	17.75	x	110.22	x	0.5	x	0.75	=	508.53	(80)
West	0.9x	0.77	x	1.44	x	110.22	x	0.5	x	0.75	=	41.25	(80)
West	0.9x	0.77	x	17.75	x	94.68	x	0.5	x	0.75	=	436.82	(80)
West	0.9x	0.77	x	1.44	x	94.68	x	0.5	x	0.75	=	35.43	(80)
West	0.9x	0.77	x	17.75	x	73.59	x	0.5	x	0.75	=	339.53	(80)
West	0.9x	0.77	x	1.44	x	73.59	x	0.5	x	0.75	=	27.54	(80)
West	0.9x	0.77	x	17.75	x	45.59	x	0.5	x	0.75	=	210.34	(80)

SAP WorkSheet: New dwelling design stage

West	0.9x	0.77	x	1.44	x	45.59	x	0.5	x	0.75	=	17.06	(80)
West	0.9x	0.77	x	17.75	x	24.49	x	0.5	x	0.75	=	112.99	(80)
West	0.9x	0.77	x	1.44	x	24.49	x	0.5	x	0.75	=	9.16	(80)
West	0.9x	0.77	x	17.75	x	16.15	x	0.5	x	0.75	=	74.52	(80)
West	0.9x	0.77	x	1.44	x	16.15	x	0.5	x	0.75	=	6.04	(80)
Northwest	0.9x	0.77	x	4.5	x	11.28	x	0.5	x	0.75	=	13.19	(81)
Northwest	0.9x	0.77	x	4.5	x	22.97	x	0.5	x	0.75	=	26.86	(81)
Northwest	0.9x	0.77	x	4.5	x	41.38	x	0.5	x	0.75	=	48.39	(81)
Northwest	0.9x	0.77	x	4.5	x	67.96	x	0.5	x	0.75	=	79.47	(81)
Northwest	0.9x	0.77	x	4.5	x	91.35	x	0.5	x	0.75	=	106.82	(81)
Northwest	0.9x	0.77	x	4.5	x	97.38	x	0.5	x	0.75	=	113.89	(81)
Northwest	0.9x	0.77	x	4.5	x	91.1	x	0.5	x	0.75	=	106.54	(81)
Northwest	0.9x	0.77	x	4.5	x	72.63	x	0.5	x	0.75	=	84.93	(81)
Northwest	0.9x	0.77	x	4.5	x	50.42	x	0.5	x	0.75	=	58.96	(81)
Northwest	0.9x	0.77	x	4.5	x	28.07	x	0.5	x	0.75	=	32.82	(81)
Northwest	0.9x	0.77	x	4.5	x	14.2	x	0.5	x	0.75	=	16.6	(81)
Northwest	0.9x	0.77	x	4.5	x	9.21	x	0.5	x	0.75	=	10.78	(81)
Rooflights	0.9x	1	x	3.12	x	26	x	0.5	x	0.75	=	27.33	(82)
Rooflights	0.9x	1	x	1.56	x	26	x	0.5	x	0.75	=	13.66	(82)
Rooflights	0.9x	1	x	3.12	x	54	x	0.5	x	0.75	=	56.77	(82)
Rooflights	0.9x	1	x	1.56	x	54	x	0.5	x	0.75	=	28.38	(82)
Rooflights	0.9x	1	x	3.12	x	96	x	0.5	x	0.75	=	100.93	(82)
Rooflights	0.9x	1	x	1.56	x	96	x	0.5	x	0.75	=	50.45	(82)
Rooflights	0.9x	1	x	3.12	x	150	x	0.5	x	0.75	=	157.7	(82)
Rooflights	0.9x	1	x	1.56	x	150	x	0.5	x	0.75	=	78.82	(82)
Rooflights	0.9x	1	x	3.12	x	192	x	0.5	x	0.75	=	201.85	(82)
Rooflights	0.9x	1	x	1.56	x	192	x	0.5	x	0.75	=	100.89	(82)
Rooflights	0.9x	1	x	3.12	x	200	x	0.5	x	0.75	=	210.26	(82)
Rooflights	0.9x	1	x	1.56	x	200	x	0.5	x	0.75	=	105.1	(82)
Rooflights	0.9x	1	x	3.12	x	189	x	0.5	x	0.75	=	198.7	(82)
Rooflights	0.9x	1	x	1.56	x	189	x	0.5	x	0.75	=	99.32	(82)
Rooflights	0.9x	1	x	3.12	x	157	x	0.5	x	0.75	=	165.06	(82)
Rooflights	0.9x	1	x	1.56	x	157	x	0.5	x	0.75	=	82.5	(82)
Rooflights	0.9x	1	x	3.12	x	115	x	0.5	x	0.75	=	120.9	(82)
Rooflights	0.9x	1	x	1.56	x	115	x	0.5	x	0.75	=	60.43	(82)
Rooflights	0.9x	1	x	3.12	x	66	x	0.5	x	0.75	=	69.39	(82)
Rooflights	0.9x	1	x	1.56	x	66	x	0.5	x	0.75	=	34.68	(82)
Rooflights	0.9x	1	x	3.12	x	33	x	0.5	x	0.75	=	34.69	(82)
Rooflights	0.9x	1	x	1.56	x	33	x	0.5	x	0.75	=	17.34	(82)
Rooflights	0.9x	1	x	3.12	x	21	x	0.5	x	0.75	=	22.08	(82)
Rooflights	0.9x	1	x	1.56	x	21	x	0.5	x	0.75	=	11.04	(82)

SAP WorkSheet: New dwelling design stage

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	590.7	1052.25	1541.1	2045.12	2389.69	2409.32	2307.97	2049.65	1717.76	1192.32	716.42	499.48

(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	2065.27	2516.75	2947.21	3359.54	3606.37	3542.32	3394.97	3151.65	2875.22	2441.74	2067.58	1931.33

(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(86)m=	0.99	0.98	0.97	0.94	0.88	0.78	0.65	0.7	0.86	0.96	0.99	0.99

(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	18.39	18.64	19.08	19.65	20.2	20.63	20.85	20.81	20.45	19.73	18.96	18.35

(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.04	20.05	20.05	20.06	20.06	20.07	20.07	20.07	20.07	20.06	20.06	20.05

(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.97	0.93	0.85	0.72	0.55	0.61	0.82	0.95	0.98	0.99

(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	16.49	16.86	17.49	18.33	19.11	19.7	19.96	19.92	19.47	18.46	17.33	16.44

(90)

fLA = Living area ÷ (4) = 0.09 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	16.65	17.01	17.63	18.45	19.2	19.78	20.03	19.99	19.56	18.56	17.47	16.61

(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	16.5	16.86	17.48	18.3	19.05	19.63	19.88	19.84	19.41	18.41	17.32	16.46

(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, hm:

(94)m=	0.98	0.97	0.94	0.9	0.82	0.69	0.53	0.58	0.78	0.92	0.97	0.98

(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	2025.84	2435.97	2782.52	3014.63	2945.43	2430.21	1797.03	1823.8	2252.61	2250.84	2006.78	1900.37

(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2

(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	7725.33	7554.06	6913.12	5843.31	4560.82	3087.82	2013.55	2108.75	3268.9	4848.05	6370.84	7678.4

(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	4240.42	3439.36	3073.16	2036.65	1201.85	0	0	0	0	1932.33	3142.12	4298.86

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 23364.75 (98)

Space heating requirement in kWh/m²/year 38.62 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0.1 (201)

SAP WorkSheet: New dwelling design stage

Fraction of space heat from main system(s)	(202) = 1 – (201) =	0.9 (202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	0.9 (204)
Efficiency of main space heating system 1		91.1 (206)
Efficiency of secondary/supplementary heating system, %		80 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	4240.42	3439.36	3073.16	2036.65	1201.85	0	0	0	0	1932.33	3142.12	4298.86	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	4189.22	3397.83	3036.06	2012.06	1187.34	0	0	0	0	1908.99	3104.18	4246.95	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 23082.63 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	530.05	429.92	384.15	254.58	150.23	0	0	0	0	241.54	392.77	537.36

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 2920.59 (215)

Water heating

Output from water heater (calculated above)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
265.98	234.73	247.21	222.57	218.81	196.52	189.69	206.83	206.06	230.75	242.78	259.9

Efficiency of water heater 79.4 (216)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(217)m=	90.23	90.16	90.01	89.67	88.9	79.4	79.4	79.4	79.4	89.55	90.05	90.26

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(219)m=	294.76	260.33	274.64	248.21	246.14	247.51	238.91	260.5	259.52	257.66	269.6	287.94

Total = Sum(219a)$_{1...12}$ = 3145.73 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		23082.63
Space heating fuel used, secondary		2920.59
Water heating fuel used		3145.73
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
oil boiler pump	100	(230d)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	130 (231)
Electricity for lighting		1124.31 (232)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year
Space heating - main system 1	(211) x	5.44 x 0.01 =	1255.69 (240)
Space heating - main system 2	(213) x	0 x 0.01 =	0 (241)
Space heating - secondary	(215) x	4.23 x 0.01 =	123.54 (242)
Water heating cost (other fuel)	(219)	5.44 x 0.01 =	171.13 (247)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	17.15 (249)

SAP WorkSheet: New dwelling design stage

(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a

Energy for lighting	(232)	13.19	x 0.01 =	148.3	(250)
Additional standing charges (Table 12)				0	(251)

Appendix Q items: repeat lines (253) and (254) as needed

Total energy cost	(245)...(247) + (250)…(254) =			1715.81	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)				0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =			1.11	(257)
SAP rating (Section 12)				84.54	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

		Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.298	=	6878.62	(261)
Space heating (secondary)	(215)	x	0.019	=	55.49	(263)
Water heating	(219)	x	0.298	=	937.43	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7871.54	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	67.47	(267)
Electricity for lighting	(232)	x	0.519	=	583.52	(268)
Total CO2, kg/year	sum of (265)…(271) =				8522.53	(272)
CO2 emissions per m²	(272) ÷ (4) =				14.09	(273)
EI rating (section 14)					82	(274)

13a. Primary Energy

		Energy kWh/year		**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211)	x	1.1	=	25390.89	(261)
Space heating (secondary)	(215)	x	1.04	=	3037.42	(263)
Energy for water heating	(219)	x	1.1	=	3460.3	(264)
Space and water heating	(261) + (262) + (263) + (264) =				31888.61	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	399.1	(267)
Electricity for lighting	(232)	x	0	=	3451.64	(268)
'Total Primary Energy	sum of (265)…(271) =				35739.35	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =				59.07	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Leanne Brooksbank	**Stroma Number:**	STRO004241
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.3.15

Property Address: Detached House

Address : Detached House, Ferry Lane, Breighton

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	320.96 (1a)	x	2.74 (2a)	=	879.43	(3a)
First floor	196.29 (1b)	x	2.67 (2b)	=	524.09	(3b)
Second floor	87.81 (1c)	x	2.41 (2c)	=	211.62	(3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	605.06	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	1615.15	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							7	x 10 =	70	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	70	÷ (5) =	0.04 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5.5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.32 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		1 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.32 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

DER WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors Type 1			3.07	x	1.8	=	5.526			(26)
Doors Type 2			1.68	x	1.8	=	3.024			(26)
Doors Type 3			1.68	x	1.8	=	3.024			(26)
Windows Type 1			17.754	x1/[1/(1.2)+ 0.04]		=	20.33			(27)
Windows Type 2			1.44	x1/[1/(1.2)+ 0.04]		=	1.65			(27)
Windows Type 3			4.5	x1/[1/(1.2)+ 0.04]		=	5.15			(27)
Windows Type 4			4.5	x1/[1/(1.2)+ 0.04]		=	5.15			(27)
Windows Type 5			15.069	x1/[1/(1.2)+ 0.04]		=	17.25			(27)
Windows Type 6			25.302	x1/[1/(1.2)+ 0.04]		=	28.97			(27)
Windows Type 7			4.05	x1/[1/(1.2)+ 0.04]		=	4.64			(27)
Rooflights Type 1			3.115	x1/[1/(1.2) + 0.04]		=	3.738			(27b)
Rooflights Type 2			1.557	x1/[1/(1.2) + 0.04]		=	1.8684			(27b)
Floor			320.96	x	0.11	=	35.3056			(28)
Walls Type1	455.49	77.61	377.89	x	0.2	=	75.58			(29)
Walls Type2	18.27	0	18.27	x	0.18	=	3.27			(29)
Walls Type3	112.23	0	112.23	x	0.26	=	29.28			(29)
Walls Type4	7.88	1.44	6.43	x	0.3	=	1.93			(29)

DER WorkSheet: New dwelling design stage

Roof Type1	132.69	0	132.69	x	0.09	=	11.94			(30)
Roof Type2	92.6	4.67	87.93	x	0.18	=	15.83			(30)
Roof Type3	4.32	0	4.32	x	0.22	=	0.95			(30)
Roof Type4	2.64	0	2.64	x	0.22	=	0.58			(30)
Roof Type5	102.79	0	102.79	x	0.2	=	20.37			(30)
Total area of elements, m²			1249.87							(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 295.1 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 27.58 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 322.69 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	310.4	308.7	307.03	299.18	297.71	290.87	290.87	289.61	293.51	297.71	300.68	303.79	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	633.09	631.38	629.71	621.86	620.39	613.56	613.56	612.29	616.19	620.39	623.37	626.47	

Average = Sum(39)$_{1...12}$ /12= 621.86 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.05	1.04	1.04	1.03	1.03	1.01	1.01	1.01	1.02	1.03	1.03	1.04	

Average = Sum(40)$_{1...12}$ /12= 1.03 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 3.53 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 118 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	129.8	125.08	120.36	115.64	110.92	106.2	106.2	110.92	115.64	120.36	125.08	129.8	

Total = Sum(44)$_{1...12}$ = 1416.02 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	192.49	168.36	173.73	151.46	145.33	125.41	116.21	133.35	134.94	157.26	171.67	186.42	

Total = Sum(45)$_{1...12}$ = 1856.63 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	28.87	25.25	26.06	22.72	21.8	18.81	17.43	20	20.24	23.59	25.75	27.96	(46)

DER WorkSheet: New dwelling design stage

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel		500	(47)
If community heating and no tank in dwelling, enter 110 litres in (47)			
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)			
Water storage loss:			
a) If manufacturer's declared loss factor is known (kWh/day):		3	(48)
Temperature factor from Table 2b		0.54	(49)
Energy lost from water storage, kWh/year	(48) x (49) =	1.62	(50)
b) If manufacturer's declared cylinder loss factor is not known:			
Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)
If community heating see section 4.3			
Volume factor from Table 2a		0	(52)
Temperature factor from Table 2b		0	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		1.62	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	50.22	45.36	50.22	48.6	50.22	48.6	50.22	50.22	48.6	50.22	48.6	50.22	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	50.22	45.36	50.22	48.6	50.22	48.6	50.22	50.22	48.6	50.22	48.6	50.22	(57)

Primary circuit loss (annual) from Table 3: 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	265.98	234.73	247.21	222.57	218.81	196.52	189.69	206.83	206.06	230.75	242.78	259.9	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	265.98	234.73	247.21	222.57	218.81	196.52	189.69	206.83	206.06	230.75	242.78	259.9	

Output from water heater (annual)$_{1...12}$: 2721.83 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	122.79	109.08	116.55	107.25	107.11	98.59	97.43	103.13	101.76	111.08	113.97	120.77	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	176.43	176.43	176.43	176.43	176.43	176.43	176.43	176.43	176.43	176.43	176.43	176.43	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	63.66	56.55	45.99	34.81	26.02	21.97	23.74	30.86	41.42	52.59	61.38	65.43	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	674.76	681.76	664.12	626.55	579.14	534.57	504.8	497.8	515.44	553.01	600.42	644.99	(68)

DER WorkSheet: New dwelling design stage

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	40.64	40.64	40.64	40.64	40.64	40.64	40.64	40.64	40.64	40.64	40.64	40.64	(69)

Pumps and fans gains (Table 5a)

(70)m=	13	13	13	13	13	13	13	13	13	13	13	13	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-141.14	-141.14	-141.14	-141.14	-141.14	-141.14	-141.14	-141.14	-141.14	-141.14	-141.14	-141.14	(71)

Water heating gains (Table 5)

(72)m=	165.04	162.31	156.65	148.96	143.96	136.93	130.95	138.61	141.33	149.3	158.29	162.33	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	992.39	989.55	955.68	899.25	838.05	782.4	748.42	756.19	787.12	843.82	909.02	961.67	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x 4.05	x	10.63	x	0.5	x	0.75	=	11.19	(74)
North	0.9x	0.77	x 4.05	x	20.32	x	0.5	x	0.75	=	21.39	(74)
North	0.9x	0.77	x 4.05	x	34.53	x	0.5	x	0.75	=	36.34	(74)
North	0.9x	0.77	x 4.05	x	55.46	x	0.5	x	0.75	=	58.38	(74)
North	0.9x	0.77	x 4.05	x	74.72	x	0.5	x	0.75	=	78.64	(74)
North	0.9x	0.77	x 4.05	x	79.99	x	0.5	x	0.75	=	84.18	(74)
North	0.9x	0.77	x 4.05	x	74.68	x	0.5	x	0.75	=	78.6	(74)
North	0.9x	0.77	x 4.05	x	59.25	x	0.5	x	0.75	=	62.36	(74)
North	0.9x	0.77	x 4.05	x	41.52	x	0.5	x	0.75	=	43.7	(74)
North	0.9x	0.77	x 4.05	x	24.19	x	0.5	x	0.75	=	25.46	(74)
North	0.9x	0.77	x 4.05	x	13.12	x	0.5	x	0.75	=	13.81	(74)
North	0.9x	0.77	x 4.05	x	8.86	x	0.5	x	0.75	=	9.33	(74)
East	0.9x	1	x 15.07	x	19.64	x	0.5	x	0.75	=	76.91	(76)
East	0.9x	1	x 15.07	x	38.42	x	0.5	x	0.75	=	150.46	(76)
East	0.9x	1	x 15.07	x	63.27	x	0.5	x	0.75	=	247.78	(76)
East	0.9x	1	x 15.07	x	92.28	x	0.5	x	0.75	=	361.37	(76)
East	0.9x	1	x 15.07	x	113.09	x	0.5	x	0.75	=	442.88	(76)
East	0.9x	1	x 15.07	x	115.77	x	0.5	x	0.75	=	453.36	(76)
East	0.9x	1	x 15.07	x	110.22	x	0.5	x	0.75	=	431.62	(76)
East	0.9x	1	x 15.07	x	94.68	x	0.5	x	0.75	=	370.76	(76)
East	0.9x	1	x 15.07	x	73.59	x	0.5	x	0.75	=	288.18	(76)
East	0.9x	1	x 15.07	x	45.59	x	0.5	x	0.75	=	178.53	(76)
East	0.9x	1	x 15.07	x	24.49	x	0.5	x	0.75	=	95.9	(76)
East	0.9x	1	x 15.07	x	16.15	x	0.5	x	0.75	=	63.25	(76)
South	0.9x	0.77	x 25.3	x	46.75	x	0.5	x	0.75	=	307.41	(78)
South	0.9x	0.77	x 25.3	x	76.57	x	0.5	x	0.75	=	503.46	(78)

DER WorkSheet: New dwelling design stage

South	0.9x	0.77	x	25.3	x	97.53	x	0.5	x	0.75	=	641.32	(78)
South	0.9x	0.77	x	25.3	x	110.23	x	0.5	x	0.75	=	724.83	(78)
South	0.9x	0.77	x	25.3	x	114.87	x	0.5	x	0.75	=	755.32	(78)
South	0.9x	0.77	x	25.3	x	110.55	x	0.5	x	0.75	=	726.89	(78)
South	0.9x	0.77	x	25.3	x	108.01	x	0.5	x	0.75	=	710.22	(78)
South	0.9x	0.77	x	25.3	x	104.89	x	0.5	x	0.75	=	689.72	(78)
South	0.9x	0.77	x	25.3	x	101.89	x	0.5	x	0.75	=	669.93	(78)
South	0.9x	0.77	x	25.3	x	82.59	x	0.5	x	0.75	=	543.03	(78)
South	0.9x	0.77	x	25.3	x	55.42	x	0.5	x	0.75	=	364.39	(78)
South	0.9x	0.77	x	25.3	x	40.4	x	0.5	x	0.75	=	265.63	(78)
Southwest	0.9x	0.77	x	4.5	x	36.79		0.5	x	0.75	=	43.03	(79)
Southwest	0.9x	0.77	x	4.5	x	62.67		0.5	x	0.75	=	73.29	(79)
Southwest	0.9x	0.77	x	4.5	x	85.75		0.5	x	0.75	=	100.28	(79)
Southwest	0.9x	0.77	x	4.5	x	106.25		0.5	x	0.75	=	124.25	(79)
Southwest	0.9x	0.77	x	4.5	x	119.01		0.5	x	0.75	=	139.18	(79)
Southwest	0.9x	0.77	x	4.5	x	118.15		0.5	x	0.75	=	138.17	(79)
Southwest	0.9x	0.77	x	4.5	x	113.91		0.5	x	0.75	=	133.21	(79)
Southwest	0.9x	0.77	x	4.5	x	104.39		0.5	x	0.75	=	122.08	(79)
Southwest	0.9x	0.77	x	4.5	x	92.85		0.5	x	0.75	=	108.58	(79)
Southwest	0.9x	0.77	x	4.5	x	69.27		0.5	x	0.75	=	81	(79)
Southwest	0.9x	0.77	x	4.5	x	44.07		0.5	x	0.75	=	51.54	(79)
Southwest	0.9x	0.77	x	4.5	x	31.49		0.5	x	0.75	=	36.82	(79)
West	0.9x	0.77	x	17.75	x	19.64	x	0.5	x	0.75	=	90.62	(80)
West	0.9x	0.77	x	1.44	x	19.64	x	0.5	x	0.75	=	7.35	(80)
West	0.9x	0.77	x	17.75	x	38.42	x	0.5	x	0.75	=	177.27	(80)
West	0.9x	0.77	x	1.44	x	38.42	x	0.5	x	0.75	=	14.38	(80)
West	0.9x	0.77	x	17.75	x	63.27	x	0.5	x	0.75	=	291.93	(80)
West	0.9x	0.77	x	1.44	x	63.27	x	0.5	x	0.75	=	23.68	(80)
West	0.9x	0.77	x	17.75	x	92.28	x	0.5	x	0.75	=	425.76	(80)
West	0.9x	0.77	x	1.44	x	92.28	x	0.5	x	0.75	=	34.53	(80)
West	0.9x	0.77	x	17.75	x	113.09	x	0.5	x	0.75	=	521.79	(80)
West	0.9x	0.77	x	1.44	x	113.09	x	0.5	x	0.75	=	42.32	(80)
West	0.9x	0.77	x	17.75	x	115.77	x	0.5	x	0.75	=	534.14	(80)
West	0.9x	0.77	x	1.44	x	115.77	x	0.5	x	0.75	=	43.32	(80)
West	0.9x	0.77	x	17.75	x	110.22	x	0.5	x	0.75	=	508.53	(80)
West	0.9x	0.77	x	1.44	x	110.22	x	0.5	x	0.75	=	41.25	(80)
West	0.9x	0.77	x	17.75	x	94.68	x	0.5	x	0.75	=	436.82	(80)
West	0.9x	0.77	x	1.44	x	94.68	x	0.5	x	0.75	=	35.43	(80)
West	0.9x	0.77	x	17.75	x	73.59	x	0.5	x	0.75	=	339.53	(80)
West	0.9x	0.77	x	1.44	x	73.59	x	0.5	x	0.75	=	27.54	(80)
West	0.9x	0.77	x	17.75	x	45.59	x	0.5	x	0.75	=	210.34	(80)

DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	1.44	x	45.59	x	0.5	x	0.75	=	17.06	(80)
West	0.9x	0.77	x	17.75	x	24.49	x	0.5	x	0.75	=	112.99	(80)
West	0.9x	0.77	x	1.44	x	24.49	x	0.5	x	0.75	=	9.16	(80)
West	0.9x	0.77	x	17.75	x	16.15	x	0.5	x	0.75	=	74.52	(80)
West	0.9x	0.77	x	1.44	x	16.15	x	0.5	x	0.75	=	6.04	(80)
Northwest	0.9x	0.77	x	4.5	x	11.28	x	0.5	x	0.75	=	13.19	(81)
Northwest	0.9x	0.77	x	4.5	x	22.97	x	0.5	x	0.75	=	26.86	(81)
Northwest	0.9x	0.77	x	4.5	x	41.38	x	0.5	x	0.75	=	48.39	(81)
Northwest	0.9x	0.77	x	4.5	x	67.96	x	0.5	x	0.75	=	79.47	(81)
Northwest	0.9x	0.77	x	4.5	x	91.35	x	0.5	x	0.75	=	106.82	(81)
Northwest	0.9x	0.77	x	4.5	x	97.38	x	0.5	x	0.75	=	113.89	(81)
Northwest	0.9x	0.77	x	4.5	x	91.1	x	0.5	x	0.75	=	106.54	(81)
Northwest	0.9x	0.77	x	4.5	x	72.63	x	0.5	x	0.75	=	84.93	(81)
Northwest	0.9x	0.77	x	4.5	x	50.42	x	0.5	x	0.75	=	58.96	(81)
Northwest	0.9x	0.77	x	4.5	x	28.07	x	0.5	x	0.75	=	32.82	(81)
Northwest	0.9x	0.77	x	4.5	x	14.2	x	0.5	x	0.75	=	16.6	(81)
Northwest	0.9x	0.77	x	4.5	x	9.21	x	0.5	x	0.75	=	10.78	(81)
Rooflights	0.9x	1	x	3.12	x	26	x	0.5	x	0.75	=	27.33	(82)
Rooflights	0.9x	1	x	1.56	x	26	x	0.5	x	0.75	=	13.66	(82)
Rooflights	0.9x	1	x	3.12	x	54	x	0.5	x	0.75	=	56.77	(82)
Rooflights	0.9x	1	x	1.56	x	54	x	0.5	x	0.75	=	28.38	(82)
Rooflights	0.9x	1	x	3.12	x	96	x	0.5	x	0.75	=	100.93	(82)
Rooflights	0.9x	1	x	1.56	x	96	x	0.5	x	0.75	=	50.45	(82)
Rooflights	0.9x	1	x	3.12	x	150	x	0.5	x	0.75	=	157.7	(82)
Rooflights	0.9x	1	x	1.56	x	150	x	0.5	x	0.75	=	78.82	(82)
Rooflights	0.9x	1	x	3.12	x	192	x	0.5	x	0.75	=	201.85	(82)
Rooflights	0.9x	1	x	1.56	x	192	x	0.5	x	0.75	=	100.89	(82)
Rooflights	0.9x	1	x	3.12	x	200	x	0.5	x	0.75	=	210.26	(82)
Rooflights	0.9x	1	x	1.56	x	200	x	0.5	x	0.75	=	105.1	(82)
Rooflights	0.9x	1	x	3.12	x	189	x	0.5	x	0.75	=	198.7	(82)
Rooflights	0.9x	1	x	1.56	x	189	x	0.5	x	0.75	=	99.32	(82)
Rooflights	0.9x	1	x	3.12	x	157	x	0.5	x	0.75	=	165.06	(82)
Rooflights	0.9x	1	x	1.56	x	157	x	0.5	x	0.75	=	82.5	(82)
Rooflights	0.9x	1	x	3.12	x	115	x	0.5	x	0.75	=	120.9	(82)
Rooflights	0.9x	1	x	1.56	x	115	x	0.5	x	0.75	=	60.43	(82)
Rooflights	0.9x	1	x	3.12	x	66	x	0.5	x	0.75	=	69.39	(82)
Rooflights	0.9x	1	x	1.56	x	66	x	0.5	x	0.75	=	34.68	(82)
Rooflights	0.9x	1	x	3.12	x	33	x	0.5	x	0.75	=	34.69	(82)
Rooflights	0.9x	1	x	1.56	x	33	x	0.5	x	0.75	=	17.34	(82)
Rooflights	0.9x	1	x	3.12	x	21	x	0.5	x	0.75	=	22.08	(82)
Rooflights	0.9x	1	x	1.56	x	21	x	0.5	x	0.75	=	11.04	(82)

DER WorkSheet: New dwelling design stage

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	590.7	1052.25	1541.1	2045.12	2389.69	2409.32	2307.97	2049.65	1717.76	1192.32	716.42	499.48

(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	1583.09	2041.8	2496.78	2944.38	3227.74	3191.72	3056.39	2805.84	2504.88	2036.13	1625.44	1461.16

(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(86)m=	1	0.99	0.98	0.95	0.9	0.81	0.69	0.74	0.89	0.97	0.99	1

(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	18.24	18.5	18.95	19.55	20.12	20.58	20.82	20.77	20.38	19.62	18.83	18.21

(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.04	20.05	20.05	20.06	20.06	20.07	20.07	20.07	20.07	20.06	20.06	20.05

(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.98	0.95	0.88	0.76	0.6	0.65	0.86	0.97	0.99	1

(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	16.28	16.66	17.31	18.18	19	19.64	19.93	19.88	19.38	18.3	17.14	16.24

(90)

fLA = Living area ÷ (4) = 0.09 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	16.45	16.82	17.45	18.3	19.1	19.72	20.01	19.96	19.46	18.41	17.28	16.41

(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	16.3	16.67	17.3	18.15	18.95	19.57	19.86	19.81	19.31	18.26	17.13	16.26

(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.96	0.92	0.84	0.72	0.57	0.62	0.82	0.94	0.98	0.99

(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	1566.77	2000.36	2396.99	2705.55	2726.55	2304.22	1738.96	1746.09	2058.55	1923.81	1597.54	1449.06

(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2

(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	7595.61	7429.55	6801.03	5752.31	4496.31	3052.32	1998	2087.55	3211.98	4752.71	6255.14	7552.13

(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	4485.46	3648.41	3276.6	2193.67	1316.7	0	0	0	0	2104.7	3353.48	4540.69

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 24919.7 (98)

Space heating requirement in kWh/m²/year 41.19 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0.1 (201)

DER WorkSheet: New dwelling design stage

Fraction of space heat from main system(s)	(202) = 1 – (201) =	0.9 (202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	0.9 (204)
Efficiency of main space heating system 1		91.1 (206)
Efficiency of secondary/supplementary heating system, %		80 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	4485.46	3648.41	3276.6	2193.67	1316.7	0	0	0	0	2104.7	3353.48	4540.69	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	4431.3	3604.36	3237.04	2167.18	1300.8	0	0	0	0	2079.29	3312.98	4485.86	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 24618.81 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	560.68	456.05	409.58	274.21	164.59	0	0	0	0	263.09	419.18	567.59

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 3114.96 (215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Output from water heater (calculated above)	265.98	234.73	247.21	222.57	218.81	196.52	189.69	206.83	206.06	230.75	242.78	259.9

Efficiency of water heater 79.4 (216)

(217)m=	90.28	90.21	90.07	89.76	89.05	79.4	79.4	79.4	79.4	89.67	90.11	90.3

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(219)m=	294.62	260.19	274.45	247.96	245.71	247.51	238.91	260.5	259.52	257.34	269.42	287.81

Total = Sum(219a)$_{1...12}$ = 3143.93 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		24618.81
Space heating fuel used, secondary		3114.96
Water heating fuel used		3143.93
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
oil boiler pump	100	(230d)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	130 (231)
Electricity for lighting		1124.31 (232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year
Space heating (main system 1)	(211) x	0.298	=	7336.4	(261)
Space heating (secondary)	(215) x	0.019	=	59.18	(263)
Water heating	(219) x	0.298	=	936.89	(264)
Space and water heating	(261) + (262) + (263) + (264) =			8332.48	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	67.47	(267)

DER WorkSheet: New dwelling design stage

Electricity for lighting	(232)	x	0.519	=	583.52 (268)
Total CO2, kg/year			sum of (265)…(271) =		8983.47 (272)
Dwelling CO2 Emission Rate			(272) ÷ (4) =		14.85 (273)
EI rating (section 14)					81 (274)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Leanne Brooksbank	**Stroma Number:**	STRO004241
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.3.15

Property Address: Detached House

Address : Detached House, Ferry Lane, Breighton

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	320.96 (1a)	x	2.74 (2a)	=	879.43	(3a)
First floor	196.29 (1b)	x	2.67 (2b)	=	524.09	(3b)
Second floor	87.81 (1c)	x	2.41 (2c)	=	211.62	(3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	605.06	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	1615.15	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							4	x 10 =	40	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.02 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.27 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		1 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.27 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

TER WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.35	0.34	0.34	0.3	0.3	0.26	0.26	0.25	0.27	0.3	0.31	0.32

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.56	0.56	0.56	0.55	0.54	0.53	0.53	0.53	0.54	0.54	0.55	0.55

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.56	0.56	0.56	0.55	0.54	0.53	0.53	0.53	0.54	0.54	0.55	0.55

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors Type 1			3.07	x	1.2	=	3.684			(26)
Doors Type 2			1.68	x	1.2	=	2.016			(26)
Doors Type 3			1.68	x	1.2	=	2.016			(26)
Windows Type 1			17.754	x	1/[1/(1.4)+ 0.04]	=	23.54			(27)
Windows Type 2			1.44	x	1/[1/(1.4)+ 0.04]	=	1.91			(27)
Windows Type 3			4.5	x	1/[1/(1.4)+ 0.04]	=	5.97			(27)
Windows Type 4			4.5	x	1/[1/(1.4)+ 0.04]	=	5.97			(27)
Windows Type 5			15.069	x	1/[1/(1.4)+ 0.04]	=	19.98			(27)
Windows Type 6			25.302	x	1/[1/(1.4)+ 0.04]	=	33.54			(27)
Windows Type 7			4.05	x	1/[1/(1.4)+ 0.04]	=	5.37			(27)
Rooflights Type 1			3.115	x	1/[1/(1.7) + 0.04]	=	5.2955			(27b)
Rooflights Type 2			1.557	x	1/[1/(1.7) + 0.04]	=	2.6469			(27b)
Floor			320.96	x	0.13	=	41.7248			(28)
Walls Type1	455.49	77.61	377.89	x	0.18	=	68.02			(29)
Walls Type2	18.27	0	18.27	x	0.18	=	3.29			(29)
Walls Type3	112.23	0	112.23	x	0.18	=	20.2			(29)
Walls Type4	7.88	1.44	6.43	x	0.18	=	1.16			(29)

TER WorkSheet: New dwelling design stage

Roof Type1	132.69	0	132.69	x	0.13	=	17.25			(30)
Roof Type2	92.6	4.67	87.93	x	0.13	=	11.43			(30)
Roof Type3	4.32	0	4.32	x	0.13	=	0.56			(30)
Roof Type4	2.64	0	2.64	x	0.13	=	0.34			(30)
Roof Type5	102.79	0	102.79	x	0.13	=	13.36			(30)
Total area of elements, m²			1249.87							(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 288.76 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 34.05 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 322.81 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	299.21	297.94	296.69	290.84	289.75	284.66	284.66	283.71	286.62	289.75	291.96	294.28	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	622.02	620.75	619.51	613.66	612.56	607.47	607.47	606.53	609.43	612.56	614.78	617.09	

Average = Sum(39)$_{1...12}$ /12= 613.65 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.03	1.03	1.02	1.01	1.01	1	1	1	1.01	1.01	1.02	1.02	

Average = Sum(40)$_{1...12}$ /12= 1.01 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 3.53 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 118 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	129.8	125.08	120.36	115.64	110.92	106.2	106.2	110.92	115.64	120.36	125.08	129.8	

Total = Sum(44)$_{1...12}$ = 1416.02 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	192.49	168.36	173.73	151.46	145.33	125.41	116.21	133.35	134.94	157.26	171.67	186.42	

Total = Sum(45)$_{1...12}$ = 1856.63 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	28.87	25.25	26.06	22.72	21.8	18.81	17.43	20	20.24	23.59	25.75	27.96	(46)

TER WorkSheet: New dwelling design stage

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel		150	(47)
If community heating and no tank in dwelling, enter 110 litres in (47)			
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)			
Water storage loss:			
a) If manufacturer's declared loss factor is known (kWh/day):		2.9	(48)
Temperature factor from Table 2b		0.54	(49)
Energy lost from water storage, kWh/year	(48) x (49) =	1.57	(50)
b) If manufacturer's declared cylinder loss factor is not known:			
Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)
If community heating see section 4.3			
Volume factor from Table 2a		0	(52)
Temperature factor from Table 2b		0	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		1.57	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	48.56	43.86	48.56	46.99	48.56	46.99	48.56	48.56	46.99	48.56	46.99	48.56	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	48.56	43.86	48.56	46.99	48.56	46.99	48.56	48.56	46.99	48.56	46.99	48.56	(57)

Primary circuit loss (annual) from Table 3: 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	264.32	233.23	245.55	220.97	217.15	194.91	188.03	205.18	204.45	229.09	241.17	258.24	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	264.32	233.23	245.55	220.97	217.15	194.91	188.03	205.18	204.45	229.09	241.17	258.24	

Output from water heater (annual)$_{1...12}$: 2702.29 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	121.46	107.88	115.22	105.97	105.78	97.3	96.1	101.8	100.47	109.75	112.68	119.44	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	176.43	176.43	176.43	176.43	176.43	176.43	176.43	176.43	176.43	176.43	176.43	176.43	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	64.54	57.33	46.62	35.29	26.38	22.27	24.07	31.28	41.99	53.31	62.23	66.34	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	674.76	681.76	664.12	626.55	579.14	534.57	504.8	497.8	515.44	553.01	600.42	644.99	(68)

TER WorkSheet: New dwelling design stage

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	40.64	40.64	40.64	40.64	40.64	40.64	40.64	40.64	40.64	40.64	40.64	40.64	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-141.14	-141.14	-141.14	-141.14	-141.14	-141.14	-141.14	-141.14	-141.14	-141.14	-141.14	-141.14	(71)

Water heating gains (Table 5)

(72)m=	163.26	160.53	154.87	147.17	142.18	135.14	129.16	136.83	139.55	147.51	156.51	160.54	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	981.49	978.55	944.54	887.95	826.63	770.92	736.96	744.84	775.91	832.76	898.08	950.79	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	4.05	x	10.63	x	0.63	x	0.7	=	13.16	(74)
North	0.9x 0.77	x	4.05	x	20.32	x	0.63	x	0.7	=	25.15	(74)
North	0.9x 0.77	x	4.05	x	34.53	x	0.63	x	0.7	=	42.74	(74)
North	0.9x 0.77	x	4.05	x	55.46	x	0.63	x	0.7	=	68.65	(74)
North	0.9x 0.77	x	4.05	x	74.72	x	0.63	x	0.7	=	92.48	(74)
North	0.9x 0.77	x	4.05	x	79.99	x	0.63	x	0.7	=	99	(74)
North	0.9x 0.77	x	4.05	x	74.68	x	0.63	x	0.7	=	92.43	(74)
North	0.9x 0.77	x	4.05	x	59.25	x	0.63	x	0.7	=	73.33	(74)
North	0.9x 0.77	x	4.05	x	41.52	x	0.63	x	0.7	=	51.39	(74)
North	0.9x 0.77	x	4.05	x	24.19	x	0.63	x	0.7	=	29.94	(74)
North	0.9x 0.77	x	4.05	x	13.12	x	0.63	x	0.7	=	16.24	(74)
North	0.9x 0.77	x	4.05	x	8.86	x	0.63	x	0.7	=	10.97	(74)
East	0.9x 1	x	15.07	x	19.64	x	0.63	x	0.7	=	90.45	(76)
East	0.9x 1	x	15.07	x	38.42	x	0.63	x	0.7	=	176.94	(76)
East	0.9x 1	x	15.07	x	63.27	x	0.63	x	0.7	=	291.39	(76)
East	0.9x 1	x	15.07	x	92.28	x	0.63	x	0.7	=	424.98	(76)
East	0.9x 1	x	15.07	x	113.09	x	0.63	x	0.7	=	520.82	(76)
East	0.9x 1	x	15.07	x	115.77	x	0.63	x	0.7	=	533.16	(76)
East	0.9x 1	x	15.07	x	110.22	x	0.63	x	0.7	=	507.59	(76)
East	0.9x 1	x	15.07	x	94.68	x	0.63	x	0.7	=	436.01	(76)
East	0.9x 1	x	15.07	x	73.59	x	0.63	x	0.7	=	338.9	(76)
East	0.9x 1	x	15.07	x	45.59	x	0.63	x	0.7	=	209.95	(76)
East	0.9x 1	x	15.07	x	24.49	x	0.63	x	0.7	=	112.78	(76)
East	0.9x 1	x	15.07	x	16.15	x	0.63	x	0.7	=	74.38	(76)
South	0.9x 0.77	x	25.3	x	46.75	x	0.63	x	0.7	=	361.52	(78)
South	0.9x 0.77	x	25.3	x	76.57	x	0.63	x	0.7	=	592.07	(78)

TER WorkSheet: New dwelling design stage

South	0.9x	0.77	x	25.3	x	97.53	x	0.63	x	0.7	=	754.19	(78)
South	0.9x	0.77	x	25.3	x	110.23	x	0.63	x	0.7	=	852.4	(78)
South	0.9x	0.77	x	25.3	x	114.87	x	0.63	x	0.7	=	888.25	(78)
South	0.9x	0.77	x	25.3	x	110.55	x	0.63	x	0.7	=	854.82	(78)
South	0.9x	0.77	x	25.3	x	108.01	x	0.63	x	0.7	=	835.22	(78)
South	0.9x	0.77	x	25.3	x	104.89	x	0.63	x	0.7	=	811.11	(78)
South	0.9x	0.77	x	25.3	x	101.89	x	0.63	x	0.7	=	787.84	(78)
South	0.9x	0.77	x	25.3	x	82.59	x	0.63	x	0.7	=	638.6	(78)
South	0.9x	0.77	x	25.3	x	55.42	x	0.63	x	0.7	=	428.52	(78)
South	0.9x	0.77	x	25.3	x	40.4	x	0.63	x	0.7	=	312.38	(78)
Southwest	0.9x	0.77	x	4.5	x	36.79		0.63	x	0.7	=	50.6	(79)
Southwest	0.9x	0.77	x	4.5	x	62.67		0.63	x	0.7	=	86.19	(79)
Southwest	0.9x	0.77	x	4.5	x	85.75		0.63	x	0.7	=	117.93	(79)
Southwest	0.9x	0.77	x	4.5	x	106.25		0.63	x	0.7	=	146.12	(79)
Southwest	0.9x	0.77	x	4.5	x	119.01		0.63	x	0.7	=	163.67	(79)
Southwest	0.9x	0.77	x	4.5	x	118.15		0.63	x	0.7	=	162.49	(79)
Southwest	0.9x	0.77	x	4.5	x	113.91		0.63	x	0.7	=	156.65	(79)
Southwest	0.9x	0.77	x	4.5	x	104.39		0.63	x	0.7	=	143.56	(79)
Southwest	0.9x	0.77	x	4.5	x	92.85		0.63	x	0.7	=	127.7	(79)
Southwest	0.9x	0.77	x	4.5	x	69.27		0.63	x	0.7	=	95.26	(79)
Southwest	0.9x	0.77	x	4.5	x	44.07		0.63	x	0.7	=	60.61	(79)
Southwest	0.9x	0.77	x	4.5	x	31.49		0.63	x	0.7	=	43.3	(79)
West	0.9x	0.77	x	17.75	x	19.64	x	0.63	x	0.7	=	106.57	(80)
West	0.9x	0.77	x	1.44	x	19.64	x	0.63	x	0.7	=	8.64	(80)
West	0.9x	0.77	x	17.75	x	38.42	x	0.63	x	0.7	=	208.46	(80)
West	0.9x	0.77	x	1.44	x	38.42	x	0.63	x	0.7	=	16.91	(80)
West	0.9x	0.77	x	17.75	x	63.27	x	0.63	x	0.7	=	343.31	(80)
West	0.9x	0.77	x	1.44	x	63.27	x	0.63	x	0.7	=	27.85	(80)
West	0.9x	0.77	x	17.75	x	92.28	x	0.63	x	0.7	=	500.7	(80)
West	0.9x	0.77	x	1.44	x	92.28	x	0.63	x	0.7	=	40.61	(80)
West	0.9x	0.77	x	17.75	x	113.09	x	0.63	x	0.7	=	613.62	(80)
West	0.9x	0.77	x	1.44	x	113.09	x	0.63	x	0.7	=	49.77	(80)
West	0.9x	0.77	x	17.75	x	115.77	x	0.63	x	0.7	=	628.15	(80)
West	0.9x	0.77	x	1.44	x	115.77	x	0.63	x	0.7	=	50.95	(80)
West	0.9x	0.77	x	17.75	x	110.22	x	0.63	x	0.7	=	598.03	(80)
West	0.9x	0.77	x	1.44	x	110.22	x	0.63	x	0.7	=	48.51	(80)
West	0.9x	0.77	x	17.75	x	94.68	x	0.63	x	0.7	=	513.7	(80)
West	0.9x	0.77	x	1.44	x	94.68	x	0.63	x	0.7	=	41.67	(80)
West	0.9x	0.77	x	17.75	x	73.59	x	0.63	x	0.7	=	399.28	(80)
West	0.9x	0.77	x	1.44	x	73.59	x	0.63	x	0.7	=	32.39	(80)
West	0.9x	0.77	x	17.75	x	45.59	x	0.63	x	0.7	=	247.36	(80)

TER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	1.44	x	45.59	x	0.63	x	0.7	=	20.06	(80)
West	0.9x	0.77	x	17.75	x	24.49	x	0.63	x	0.7	=	132.87	(80)
West	0.9x	0.77	x	1.44	x	24.49	x	0.63	x	0.7	=	10.78	(80)
West	0.9x	0.77	x	17.75	x	16.15	x	0.63	x	0.7	=	87.63	(80)
West	0.9x	0.77	x	1.44	x	16.15	x	0.63	x	0.7	=	7.11	(80)
Northwest	0.9x	0.77	x	4.5	x	11.28	x	0.63	x	0.7	=	15.52	(81)
Northwest	0.9x	0.77	x	4.5	x	22.97	x	0.63	x	0.7	=	31.59	(81)
Northwest	0.9x	0.77	x	4.5	x	41.38	x	0.63	x	0.7	=	56.91	(81)
Northwest	0.9x	0.77	x	4.5	x	67.96	x	0.63	x	0.7	=	93.46	(81)
Northwest	0.9x	0.77	x	4.5	x	91.35	x	0.63	x	0.7	=	125.62	(81)
Northwest	0.9x	0.77	x	4.5	x	97.38	x	0.63	x	0.7	=	133.93	(81)
Northwest	0.9x	0.77	x	4.5	x	91.1	x	0.63	x	0.7	=	125.29	(81)
Northwest	0.9x	0.77	x	4.5	x	72.63	x	0.63	x	0.7	=	99.88	(81)
Northwest	0.9x	0.77	x	4.5	x	50.42	x	0.63	x	0.7	=	69.34	(81)
Northwest	0.9x	0.77	x	4.5	x	28.07	x	0.63	x	0.7	=	38.6	(81)
Northwest	0.9x	0.77	x	4.5	x	14.2	x	0.63	x	0.7	=	19.52	(81)
Northwest	0.9x	0.77	x	4.5	x	9.21	x	0.63	x	0.7	=	12.67	(81)
Rooflights	0.9x	1	x	3.12	x	26	x	0.63	x	0.7	=	32.14	(82)
Rooflights	0.9x	1	x	1.56	x	26	x	0.63	x	0.7	=	16.07	(82)
Rooflights	0.9x	1	x	3.12	x	54	x	0.63	x	0.7	=	66.76	(82)
Rooflights	0.9x	1	x	1.56	x	54	x	0.63	x	0.7	=	33.37	(82)
Rooflights	0.9x	1	x	3.12	x	96	x	0.63	x	0.7	=	118.69	(82)
Rooflights	0.9x	1	x	1.56	x	96	x	0.63	x	0.7	=	59.33	(82)
Rooflights	0.9x	1	x	3.12	x	150	x	0.63	x	0.7	=	185.45	(82)
Rooflights	0.9x	1	x	1.56	x	150	x	0.63	x	0.7	=	92.7	(82)
Rooflights	0.9x	1	x	3.12	x	192	x	0.63	x	0.7	=	237.38	(82)
Rooflights	0.9x	1	x	1.56	x	192	x	0.63	x	0.7	=	118.65	(82)
Rooflights	0.9x	1	x	3.12	x	200	x	0.63	x	0.7	=	247.27	(82)
Rooflights	0.9x	1	x	1.56	x	200	x	0.63	x	0.7	=	123.59	(82)
Rooflights	0.9x	1	x	3.12	x	189	x	0.63	x	0.7	=	233.67	(82)
Rooflights	0.9x	1	x	1.56	x	189	x	0.63	x	0.7	=	116.8	(82)
Rooflights	0.9x	1	x	3.12	x	157	x	0.63	x	0.7	=	194.11	(82)
Rooflights	0.9x	1	x	1.56	x	157	x	0.63	x	0.7	=	97.02	(82)
Rooflights	0.9x	1	x	3.12	x	115	x	0.63	x	0.7	=	142.18	(82)
Rooflights	0.9x	1	x	1.56	x	115	x	0.63	x	0.7	=	71.07	(82)
Rooflights	0.9x	1	x	3.12	x	66	x	0.63	x	0.7	=	81.6	(82)
Rooflights	0.9x	1	x	1.56	x	66	x	0.63	x	0.7	=	40.79	(82)
Rooflights	0.9x	1	x	3.12	x	33	x	0.63	x	0.7	=	40.8	(82)
Rooflights	0.9x	1	x	1.56	x	33	x	0.63	x	0.7	=	20.39	(82)
Rooflights	0.9x	1	x	3.12	x	21	x	0.63	x	0.7	=	25.96	(82)
Rooflights	0.9x	1	x	1.56	x	21	x	0.63	x	0.7	=	12.98	(82)

TER WorkSheet: New dwelling design stage

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	694.66	1237.44	1812.33	2405.06	2810.27	2833.36	2714.17	2410.38	2020.08	1402.16	842.51	587.39	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	1676.15	2215.99	2756.87	3293.01	3636.9	3604.28	3451.13	3155.22	2795.99	2234.92	1740.59	1538.19	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	1	0.99	0.97	0.88	0.72	0.79	0.96	1	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.62	19.76	20.01	20.34	20.65	20.89	20.97	20.95	20.76	20.34	19.92	19.6	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.06	20.06	20.06	20.07	20.07	20.08	20.08	20.08	20.08	20.07	20.07	20.07	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	1	0.99	0.95	0.81	0.6	0.67	0.94	1	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.17	18.39	18.75	19.23	19.68	19.99	20.07	20.06	19.84	19.24	18.62	18.14	(90)

fLA = Living area ÷ (4) = 0.09 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.29	18.51	18.86	19.33	19.77	20.06	20.14	20.13	19.92	19.33	18.73	18.27	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.29	18.51	18.86	19.33	19.77	20.06	20.14	20.13	19.92	19.33	18.73	18.27	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	1	1	0.99	0.94	0.81	0.61	0.68	0.93	1	1	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	1675.99	2214.96	2750.59	3252.88	3436.22	2925.45	2093.17	2152.93	2598.1	2224.85	1740.08	1538.1	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	8704.56	8445.64	7654.99	6399.62	4941.74	3319.02	2153.2	2264.51	3544.78	5349.84	7148.91	8681.81	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	5229.25	4187.01	3648.88	2265.65	1120.11	0	0	0	0	2324.99	3894.36	5314.92	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 27985.17 (98)

Space heating requirement in kWh/m²/year 46.25 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

TER WorkSheet: New dwelling design stage

Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	5229.25	4187.01	3648.88	2265.65	1120.11	0	0	0	0	2324.99	3894.36	5314.92	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	5592.78	4478.09	3902.54	2423.16	1197.98	0	0	0	0	2486.62	4165.09	5684.41	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 29930.67 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Output from water heater (calculated above)	264.32	233.23	245.55	220.97	217.15	194.91	188.03	205.18	204.45	229.09	241.17	258.24	
Efficiency of water heater													79.8 (216)
(217)m=	89.92	89.86	89.74	89.43	88.57	79.8	79.8	79.8	79.8	89.42	89.8	89.94	(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m													
(219)m=	293.95	259.53	273.62	247.07	245.17	244.25	235.63	257.11	256.2	256.18	268.57	287.12	

Total = Sum(219a)$_{1...12}$ = 3124.42 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		29930.67
Water heating fuel used		3124.42
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75 (231)
Electricity for lighting		1139.82 (232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	6465.02	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	674.88	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7139.9	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	591.57	(268)

TER WorkSheet: New dwelling design stage

Total CO2, kg/year	sum of (265)…(271) =	7770.39	(272)
TER =		14.85	(273)

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 24 October 2016

Property Details: Detached House

Dwelling type:	Detached House
Located in:	England
Region:	East Pennines
Cross ventilation possible:	Yes
Number of storeys:	3
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	None
Ventilation rate during hot weather (ach):	4 (Windows open half the time)

Overheating Details:

Summer ventilation heat loss coefficient:	2131.99	**(P1)**
Transmission heat loss coefficient:	322.7	
Summer heat loss coefficient:	2454.68	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
West (West elevation)	0	1
West (Wesr dormer windows)	0	1
North West (Bays)	0	1
South West (Bays)	0	1
East (East elevation)	0	1
South (South elevation)	0	1
North (North elevation)	0	1
East (East roof windows)	0	1
South (South roof windows)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
West (West elevation)	1	0.9	1	0.9	**(P8)**
West (Wesr dormer windows)	1	0.9	1	0.9	**(P8)**
North West (Bays)	1	0.9	1	0.9	**(P8)**
South West (Bays)	1	0.9	1	0.9	**(P8)**
East (East elevation)	1	0.9	1	0.9	**(P8)**
South (South elevation)	1	0.9	1	0.9	**(P8)**
North (North elevation)	1	0.9	1	0.9	**(P8)**
East (East roof windows)	1	1	1	1	**(P8)**
South (South roof windows)	1	1	1	1	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**
West (West elevation)	0.9 x	17.75	110.22	0.5	0.75	0.9	594.38
West (Wesr dormer windows)	0.9 x	1.44	110.22	0.5	0.75	0.9	48.21
North West (Bays)	0.9 x	4.5	91.1	0.5	0.75	0.9	124.52
South West (Bays)	0.9 x	4.5	113.91	0.5	0.75	0.9	155.7
East (East elevation)	0.9 x	15.07	110.22	0.5	0.75	0.9	504.49
South (South elevation)	0.9 x	25.3	108.01	0.5	0.75	0.9	830.12

SAP 2012 Overheating Assessment

North (North elevation)	0.9 x	4.05	74.68	0.5	0.75	0.9	91.87	
	1 x	3.12	189	0.5	0.75	1	198.7	
	1 x	1.56	189	0.5	0.75	1	99.32	
						Total	2647.31	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	1119.99	1074	1089.01	
Total summer gains	3882.84	3721.31	3442.9	**(P5)**
Summer gain/loss ratio	1.58	1.52	1.4	**(P6)**
Mean summer external temperature (East Pennines)	14.6	16.6	16.4	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	17.48	19.42	19.1	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Not significant**	**Not significant**	

Assessment of likelihood of high internal temperature: Not significant